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Chapter on Thunder and Lightning - 1858

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THE GIFT OF
CHARLES H. TAYLOR

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A CHAPTER
ON
THUNDER AND LIGHTNING,
THEIR CAUSES AND EFFECTS;

TOGETHER WITH A DESCRIPTION OF

DAVID MUNSON'S
COPPER TUBULAR LIGHTNING ROD,
WITH SPIRAL FLANGES,

AS A PERFECT PROTECTION AGAINST THE DISASTERS OF ELECTRICITY.

INDIANAPOLIS:
INDIANAPOLIS JOURNAL COMPANY, PRINTERS.
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THUNDER AND LIGHTNING:

THEIR CAUSES AND EFFECTS.

INTRODUCTION.

If there be one time more than another, in which man feels that he is entirely in the hands of One mightier than himself, in which all his personal pride sinks in the conviction of his utter helplessness, it is when the forked bolts of heaven glare about him with frightful brightness, and the dread artillery of the skies stuns him with its deafening peals, and shakes the very earth on which he treads. Then it is that his conscience tells him how entirely dependent he is; and how, in a moment, the next flash might be to him the instrument of death, without his having the slightest power to arrest his fate. In respect to the other great and irresistible powers of nature, man, in some sort, seeks them out—the lightning's flash seeks out him. It is true, he may go to shores where thunderstorms are less violent, or to others where they are much more violent than in his own land; but, regarding it generally, lightning is no respecter of time nor place; it was as much known to the ancients as to ourselves; it comes to us, so to speak, "in season and out of season"—its geographical distribution is less restricted than that of any other of Nature's great phenomena.

With this startling admonition before him, let any one of the readers of these observations pause for a moment and count the number of lightning-rods in his own neighborhood.

Does he hesitate? He thinks there may be one on the village spire, and perhaps another on yon tall chimney; but where else, he knows not. Now, he is led to ask, What is the cause of this apparent neglect? Why this consummate audacity in trifling with the eternal laws of Nature by erecting monuments and inviting down the fire of heaven, and providing no means of conducting it safely away?

Although the extreme magnitude of accidents by lightning cannot be otherwise than recognized by all, and the almost certainty of some one or more buildings being the marked victims at every season, yet each man builds with the chance of his edifice not being the fatal one. Amongst so many, the chances are so much in his favor that he will run the risk; or else he comes to the still more unphilosophical conclusion that, as storm after storm has left him unscathed, so will he forever be safe.

THUNDER-STORMS.

When and Where.—Thunder-storms prevail most in the torrid zone, and decrease in frequency towards either pole.

During a residence of six years in Greenland, 70° N. Lat., Gisecke heard the rolling of thunder but once; and, according to the testimony of the arctic navigators, Scoresby, Parry and others, thunder-storms rarely occur between the 70th and 75th degree of north latitude; and never beyond the latter parallel. As respects time, they are more frequent during the summer months.

Thunder-storms are most violent within the torrid zone. Here the play of the lightning is incessant, and the crashing bursts of thunder most terrific; and none but those who have actually witnessed a tropical tempest, can form an idea of its awful power. Occasionally in the higher latitudes fierce storms occur.

How Produced.—The thunder-storm is produced in the same manner as the common rain-storm; namely, by the condensation of atmospheric vapor; but it differs in two respects; first, in the rapidity of this condensation, and secondly, in the accumulation of electricity resulting therefrom.

When vapor is condensed, electricity is developed. The cloud in the very process of formation becomes electrified, and to its own electricity is added that which collects upon its surface from the atmosphere; whether derived from evaporation, combustion, vegetation, friction, or any other source.

This condensation must be copious, or the electricity would be weak; it must also be rapid, else it will escape too fast from the cloud, and never collect in sufficient strength.

Thunder-storms are usually attended by a change in the direction of the wind, which accounts for the condensation of atmospheric vapor; indeed, one of the most sublime elements of a storm of this nature, is the conflict and raging of opposing currents.

Since the air abounds with vapor when its temperature is high, the condensation will be most copious if a loss of heat then suddenly takes place. We therefore easily perceive the reason, why thunder-storms are more frequent in summer than in winter, in low than in high latitudes, and their intensity greatest in the tropic climes.

For the same reason they happen more frequently after mid-day than in the morning.

Thunder Clouds.—Since the air surrounding it is a non-conductor, a single thunder-cloud floats in the atmosphere a vast insulated conductor; its electricity being spread over the surface of the globules of which it is composed, and there retained by the pressure of the atmosphere.

Thunder-clouds may be either positively or negatively electrified; and the observations of Mr. Crosse lead to the conclusion, that at times a cloud of this kind is complex, consisting of a series of concentric bands or zones, alternately positive and negative; the electricity being weakest at the edges of the cloud, and strongest at the centre.

The earth may be regarded as a reservoir of electricity: when, therefore, an electrified cloud floats near its surface, it induces the opposite electricity upon the ground immediately beneath it.

The cloud may approach so near, that the mutual attraction of the two electricities overcomes the pressure of the atmosphere; a union then occurs, and the lightning, at the same moment, is seen darting between the cloud and the earth, and soon after the rolling of thunder is heard.

A similar inductive action arises between the clouds themselves; for, if two clouds differently electrified approach other, the electricity upon the nearest opposite surfaces augments in intensity, and often increases to such a degree that a discharge takes place, the lightning then flashing from cloud to cloud. It may sometimes happen, that the path of least resistance will not be directly through the air, but from the first cloud to the earth, and from the earth to the second cloud, and under these circumstances the lightning will take the latter route.

LIGHTNING.

Cause of Lightning.—When a portion of air is subjected to a very sudden and powerful compression, a spark is elicited: that electricity produces such a compression can be proved by experiment, and to the energetic condensation of the atmosphere before the electric fluid, in its rapid progress from point to point, is attributed the vivid flashes that illumine the stormy sky.

Kinds of Lightning.—Lightning has been divided by Arago into three kinds, principally distinguished by their form, viz., zigzag-lightning, sheet-lightning, and ball-lightning.

Zigzag-Lightning.—This kind is so called from the peculiarity of its figure, which is thus explained. As the electricity

passes through the atmosphere, the air is supposed, at length, to be so powerfully compressed before it, that a great resistance is presented, and the electric fluid then finds an easier route in some other direction. In this it proceeds, until it once more meets with a like opposition, and is compelled again to change its course; and thus it continues glancing from side to side, until at last it reaches the place it seeks.

Zigzag-lightning appears as a narrow, jagged line of intensely vivid light, traversing space with extreme velocity. On account of the unequal conducting power of different portions of the atmosphere, the flash sometimes divides, branching out in several different directions; the lightning is then said to be forked. A division into three distinct lines is of rare occurrence; but even more have been seen, for Kaemtz beheld, at Halle, in June, 1834, a flash of lightning which threw out numerous branches at the sides; the whole presenting the figure of a spine, with its supporting ribs.

It is said that zigzag-lightnings usually pass between the clouds and the earth, seldom flashing from cloud to cloud.

Sheet-Lightning.—This kind is the most common, and appears during a storm as a diffuse glow of light, illuminating the edges of the clouds; and at times breaking out from the central mass. When it occurs, the clouds are said to open. The flashes of sheet-lightning often follow each other in rapid succession, for the space of many hours; their intensity is by no means great, and the thunder which attends them is low and distant.

Ball-Lightning—Is extremely rare, and so singular are its attendant phenomena, that we might well doubt its existence, were not the instances of its occurrence fully authenticated. In a storm that happened at Steeple Aston, Wiltshire, in 1772, the Rev. Messrs. Pitcairne and Wainhouse, while in the vestry of the church, saw suddenly before them, at the distance of a foot, and at about their own height from the floor, a ball of fire, nearly the size of a man's fist, surrounded by a black smoke. It burst with an explosion like the discharge of

several cannon. Pitcairne was dangerously wounded, and his person and clothes showed the usual marks of lightning.

During a thunder-storm that occurred in 1809, at Newcastle on Tyne, the house of David Sutton was struck: the lightning descending the chimney. After the explosion, several persons who were assembled in a room, saw at the door a globe of fire, which, after remaining stationary for some time, advanced into the middle of the room, where it burst into fragments, with a report like a rocket.

Heat-Lightning.—It not unfrequently happens, during the serene evenings of summer, that the horizon is illumined for many hours with successive flashes of light, unattended with thunder. This is called heat-lightning, and has much perplexed meteorologists. It is affirmed by some, that this illumination is the reflection from the atmosphere of the lightnings of remote storms; the storms themselves being so far distant, that their thunders cannot be heard. Others assert, that during warm, sultry weather, when the air is highly rarefied, its pressure upon the clouds is so much diminished, that the electric fluid can never accumulate upon their surface beyond a certain point, when it escapes in noiseless flashes to the earth.

Multiplied observations have proved, that heat-lightning generally originates in the first-mentioned cause; but the instances are by no means rare, when silent flashes of electric light play between the earth and the clouds. These cases occur when the weather is sultry, the air being then both rarefied and moist; two conditions which lessen its non-conducting power; the atmosphere thus becomes an imperfect conductor between the clouds and the earth, which are in opposite electrical states, and opposes just sufficient resistance to the passage of the electric fluid as to render it visible.

Velocity of Lightning.—By a very ingenious piece of apparatus, Prof. Wheatstone, of King's College, London, has been enabled to show that the duration of a flash of lightning is less than the thousandth part of a second, and Arago has demonstrated that it does not exceed the millionth part.

Now the duration of a flash, is the time it occupies in traversing the space between the clouds, or between a cloud and the earth; if we then estimate this distance to be equal sometimes to a quarter of a mile, which is a low computation, the velocity of lightning, in such cases, according to Arago, could not be less than 250,000 miles per second. The electricity developed by the electrical machine, has been shown, by another beautiful contrivance of Prof. Wheatstone, to possess a speed of 288,000 miles per second: the rapidity of lightning is probably not less.

The preceding remarks apply only to lightnings of the first and second class. Ball-lightning, on the contrary, often moves slowly, and is visible for many seconds.

Effects of Lightning.—These are precisely similar to those of common electricity in kind, though far exceeding them in degree. Life is destroyed by the shock, the stoutest trees shivered to pieces, ponderous weights displaced, combustibles inflamed, metals softened and fused, and vitrified, and iron and steel rendered magnetic. It is needless to multiply instances in proof of these particular points, but a few cases may tend to impress them upon the mind.

On the night of the 21st of June, 1723, a tree in the forest of Nemours was struck by lightning. The trunk was split into two fragments, one seventeen feet long, the other twenty-two; and though the first required four men to lift it, and the second eight, yet both of them were hurled to a distance of seventeen yards. On the 6th of August, 1809, a flash of lightning struck a house at Swinton, near Manchester. The wall of a building attached to the house was loosened from its foundation a foot below the ground, and raised in a mass to the surface, still maintaining its upright position; one end of it was moved nine, and the other four feet from its original place. The wall thus moved was eleven feet high and three feet thick, and contained 7,000 bricks, which, exclusive of the mortar, were estimated to weigh nearly twenty-six tons.

On the 20th of April, 1807, at Great Mouton, in Lancashire, a windmill was struck by lightning; the fluid passed along a

large iron chain, the links of which were so softened, that by their own weight they became welded together; and the chain was converted into an inflexible bar of iron.

In September, 1845, a house at New Haven, Ct., was struck during a thunder-storm. Several articles of steel were rendered magnetic, and a razor, lying in a case near the spot where the lightning entered, was found capable of sustaining a key, weighing half an ounce.

Thunder-storms are more frequent in summer than in winter; though, according to Schubler, the electrical charge of the air is less intense at that season in clear, and even in cloudy weather. Pliny remarks, that lightning is more common in autumn and spring than in summer or winter. But Arago infers that thunder-storms, if less frequent, are more dangerous in winter than in summer, from the following facts, compiled from Harris's papers: Out of all the ships struck by lightning between the Mediterranean and the coast of England, from 1781 to 1832, twenty-three cases belong to the first four months of the year; sixteen occurred in the last four months of the year, and only four in the other months.

Pliny mentions a tower so often struck, that its renewal was finally abandoned. A school-house in Lammer Muier was struck on three different occasions. In 1826, the same house in Weathersfield, Conn., was struck twice in an interval of only two or three days. Hutchinson says that, at Jamaica, the clouds at noon cover the mountains at Port Royal; it then thunders so loudly that the sound is heard at Kingston. At half-past two in the afternoon the sky is clear again. These changes of weather occur every day for five months, from November to April. In Boston, the same steeple has been struck repeatedly. In 1763, the steeple of Antrasme was struck twice during the same storm. On the 25th of April, 1760, the lightning fell three times in twenty minutes on the buildings of Notre Dame de Ham. On the night of the 14th of April, 1718, twenty-four steeples were struck along the coast of Brittany; and on the 11th of January, 1815, twelve steeples suffered a similar fate in the Rhenish provinces. In

1788, a German antiquarian in this province of meteorology found that, within the period of thirty-three years, three hundred and eighty-six steeples had been struck, and one hundred and twenty-one ringers killed.

There is a great difference of exposure observable in various Departments of France. And the fatality of single years is not the same even at the same place. In 1805, only one individual is known to have been killed in France by lightning. In 1797, twenty-four were struck and seventeen killed. In 1819, twenty-two were killed. In other places, nine individuals have been killed at once and eighty-two wounded. On the 18th of February, 1770, all the inhabitants of Keverne, in Cornwall, who were in church, were thrown to the ground. In 1797, between June and August, eighty-four accidents and seventeen deaths occurred in the United States from thunder and lightning, as Volney found from the newspapers of this country. I have preserved accounts of three persons killed in 1850 in this country, fourteen in 1851, (and five churches struck,) six in 1852, thirteen in 1853, and twenty-two in 1854, besides many injured.

In 1417, the steeple of St. Mark, in Venice, was struck by lightning and burned. It was rebuilt, and again reduced to ashes on the 12th of August, 1489. It was afterwards built of stone, and was struck again on the 23d of April, 1745. The repairs this time cost eight thousand ducats. On the 27th of July, 1759, lightning burnt all the wood-work of the Cathedral of Strasburg. It was proposed to place conductors upon it, but there was some objection on account of the expense. On the 14th of August, 1833, it was struck three times within a quarter of an hour, and so much damaged that the repairs cost \$6,000,000. There was still some hesitation in regard to lightning-rods, when it was struck once more on the 19th of July, 1834. Rods were placed upon it in 1835, at an expense of only \$3,000. On the 10th of July, 1843, it was struck twice, but the rods saved it.

Fulgurites.—When a flash of lightning falls upon sand, its path below the surface is often marked by a fulgurite, so called

from the Latin word *fulgur*, lightning. It is a tube composed of sand, vitrified by the action of the lightning. Fulgurites were first discovered in Silesia, in 1711, and specimens were forwarded to the museum at Dresden, where they are still preserved: they have since been found in great numbers, in Germany, England, and amid the sands of Bahia, in Brazil.

The fulgurite is winding in its form, often throws out lateral spurs or branches, and contracts in size towards the lower extremity, which usually terminates at a spring of water, or in some substance that is a good conductor of electricity.

These tubes are generally hollow, the interior surface being coated with a brilliant glass. Their diameters vary from four-hundredths of an inch, to three inches and a half, and the thickness of their sides from one-fiftieth of an inch, to nearly an inch.

The branches of the fulgurite differ in length from three quarters of an inch to a foot, but the main tube often extends to the depth of many yards. Several of considerable length, which had been taken from the sandy plains of Silesia, were exhibited at London, some years ago, by Dr. Fiedler, of Germany. One, discovered at Paderborn, in Westphalia, was forty feet long.

That these tubes are really produced by lightning, has been proved by actual observation. A number of sailors, being upon the isle of Amrum, in Denmark, saw a flash of lightning fall upon the sand; upon examining the spot, they found a fulgurite: a similar circumstance happened on the borders of Holland. Savart and others have obtained artificial fulgurites, by passing powerful electric sparks through powdered glass, and a mixture of sand and salt; tubes were thus formed an inch in length, and the tenth of an inch in thickness, the inner diameter being the twenty-fifth of an inch. Hence it would appear that the Tubular Spiral form of a Conductor is just the form required by the nature of the fluid.

THUNDER.

Its Cause.—In consequence of the lightning passing through the atmosphere with an amazing velocity, it leaves a void space behind it, into which the surrounding air instantly rushes, with a loud report. This noise is thunder.

When the lightning is near the observer, the report is sharp and quick, but when at a distance, it is long and rolling.

The rolling of thunder is frequently occasioned by the reverberations of the sound, from clouds and adjacent mountains; but this is by no means always the case. When the lightning-flash darts to a great distance, such is its velocity, that the thunder may be considered as occurring at every point of the flash at the same time. But sound has a progressive motion of 1142 feet per second, and all the thunder will not reach the ear at the same instant. It will be first heard from the nearest point, in the path of the flash, and later and later from points more remote; and the combined effect will be a continued peal.

The zigzag form of the flash, and its division into several streams, is regarded by Herschel as affording an adequate explanation for all the changes that occur in the sound of the thunder-peal.

The time that elapses between the lightning and the thunder, enables us to form an estimate of the distance of the former, which is a little more than a mile for every five seconds. This interval usually varies from three to sixteen seconds; but cases have occurred, where it has amounted to fifty, and even seventy-two seconds.

Electricity—Is a subtle fluid, distributed through all substances, and lying buried beneath their surface in a condition of equilibrium or rest. Various causes may disturb this state, producing electrical excitement, when the fluid is supposed to accumulate in some substances to excess, which are then said to be positively electrified. Some substances, as the

metals, allow electricity to pass over them freely; these are called good conductors, others refuse to convey it, and are termed non-conductors, as silk, glass, air. When from any cause excitement has taken place, and a body has been charged with electricity or robbed of it to a certain degree, there is no escape; if a good conductor be presented to it, it flows off quietly; if a bad conductor, it dashes through it, producing fire, and perhaps violent rapture.

Safety During Storms.—During a thunder-storm shelter should not be taken under trees and hedges, which are likely to act as conductors; but, at the same time, a person is safer when at the distance of about thirty or forty feet from such objects, than on an open plain. Water should be carefully avoided, because it is a good conductor, and the height of a man above it may determine the course of the lightning. In a house, the safest position is near the middle of the room, and the security may be increased by sitting on a feather bed or hair mattress, or thick woollen rug, all of which are bad conductors. It is dangerous to be near the fireplace, because the chimney is the part most likely to be struck, and the soot and heat are powerful conductors.

THE LIGHTNING ROD.

When Invented.—The identity of lightning with electricity, though it had been previously suspected, was first directly demonstrated by the celebrated Dr. Franklin, in the year 1749, by drawing sparks from the electric kite. This experiment was as follows: Having made a kite by tying the corners of a large silk handkerchief to the ends of two light strips of cedar that crossed each other, and placed upon it a pointed iron wire connected with the string, Franklin went out into a field upon the approach of a thunder-storm, accompanied by his son. When the kite was raised, he attached a key to the lower end of the hempen string; to the key, one end of a silk

ribbon was now tied, the other being fastened to a post. The kite was thus insulated, and the experimenter, for a considerable time, awaited the result with intense solicitude. A dense cloud passed over, but no indications of electricity appeared on the string; when just as Franklin began to despair of success, he beheld the loose fibers of the cord starting asunder, and immediately presenting his knuckle to the key, received an electric spark. The rain now descending, increased the conducting power of the string, and vivid electric sparks issued from the key in great abundance. By means of the lightning thus obtained, all the common electrical experiments were performed, and the identity of lightning and electricity thus indubitably proved. No sooner was this wonderful discovery made known, than men of science in different parts of the world repeated the experiment with the most brilliant and astonishing results. They were however attended with great danger, proving the death of several eminent men, and among the number, Prof. Richman, of St. Petersburg.

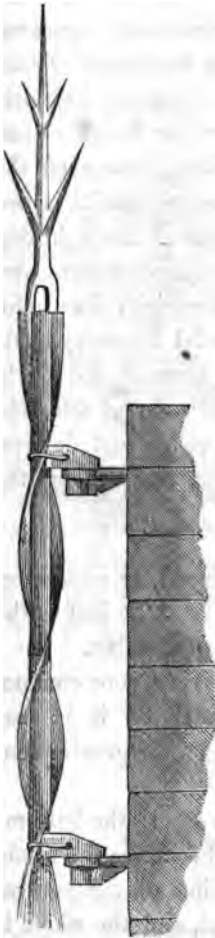
Requisites.—In order that the lightning-rod, or conductor, may afford an effectual protection, regard must be had to the material of which it is made, and the mode of erection.

Wrought iron is usually employed, but forms a poor conductor; Copper is much preferable, inasmuch as it is less liable to be corroded or fused, and possesses a far greater conducting power.

The rod should be continuous from the top to the bottom; an entire metallic communication existing throughout its whole length. This law is violated, when the joints of the several parts that form the conductor are imperfect, and the whole is loosely put together.

It is highly probable, that a silent and gradual discharge of a thunder-cloud, is often effected by the points of the rod, and an explosion thus prevented. This is the opinion of Arago, who expressly states, that "lightning-rods not only render strokes of lightning inoffensive, but considerably diminish the chance of a building being struck at all."

MUNSON'S ROD.



After a careful study of the mysterious fluid, by Mr. DAVID MUNSON, of Indianapolis, Ind., embracing many experiments, at great expense, a Rod was invented by him which embodies all the requisites for a perfect protection against lightning. It is made of Copper, that metal being one of the very best conductors; and of sheet-copper so as to make it within the reach of every householder; and of a tubular, spiral form, that being the natural shape of the "thunder bolt," as demonstrated when a flash of lightning penetrates the sand. The flanges and rough edges upon the surface tend to dissipate the fluid, and thus destroy its force, carrying it off harmless into the earth. Copper possesses six times the conducting power of iron, and the peculiar shape of Munson's Rod adds nearly as much more power, and gives great strength. It is but slightly affected from long atmospheric exposure, while the ordinary iron rod soon rusts and becomes useless. The tendency of electricity is to collect on the surface of a conducting body, and hence another reason for having a tube, as the body of the rod thereby obtains large extent of surface inside and out; this, too, is the form giving the greatest degree of strength in proportion to a given amount of metal. This form admits of the passage of a large quantity of water to the earth where the rod enters, and this is a great advantage, as the earth admits electricity much more freely when moist.

Conducting Power of Metals.—The following shows the relative conducting power of the respective metals: Silver, 120; Copper, 120; Gold, 80; Zinc, 40; Platinum, 24; Iron, 24; Tin, 20; Lead, 12.

Superiority of Munson's Rod.—The old iron rod has but a small power of conduction, as compared with Munson's rod. Draper's Chemistry says, and experiment has demonstrated the fact, that lightning does not distribute itself through the body of the rod, but remains upon the surface; hence the extent of the surface is the measure of power in any conductor. M. Pouillet makes the conducting power of copper from $5\frac{1}{2}$ to $6\frac{1}{2}$ times that of iron, Dr. Priestly makes it five times as much; and Prof. Faraday, 6 2-5 times as much. An old fashioned iron conductor of one-half inch in diameter has, say, (three times its diameter,) one inch and a half of surface—we will call its conducting power three. Now Munson's copper rod has a surface in and outside of $3\frac{1}{2}$ inches, or $2\frac{1}{2}$ times the surface of the iron rod. These facts give Munson's Rod a conducting power of forty-five: $3 \times 6 \times 2\frac{1}{2} = 45$; thus showing clearly that Munson's rod, in its capacity to conduct lightning, is equal to fifteen ordinary iron ones.



Directions for Putting up Munson's Rod.

The Rods are in five feet lengths, and the connections are made by lapping and wiring. Where cornices are to be turned, it will be better to put the rod up in lengths of fifteen feet—holes for wiring should be punched on the ground. Put up the top section first, and let it extend about five feet above the chimney. Make the turn around the cornice before making that section fast to the insulators. It is best to avoid angles as much as possible, and they should never be abrupt. The Rod should extend far enough below the surface of the ground to reach a permanently moist stratum of earth, say four feet. The hole may be made in the earth with an iron bar. The insulators are rights and lefts, and with proper care and a little management the rods can be attached so as to be perfectly firm.

ENDORSEMENTS.

This Rod has received the first premiums, at the American Institute, New York City; the Franklin Institute, Philadelphia; the National Fair, Louisville, Ky.; the State Fairs of Ohio, Indiana, Connecticut, and wherever exhibited. It has been adopted by the Building Committee of the Cincinnati School Board; and has received unsolicited commendations from the *New York Tribune*, *Indianapolis Journal*, the *State Sentinel*, *Cincinnati Medical Observer*, and numerous other publications of acknowledged merit; and in addition, the highest praise from many of the most scientific men of the country.

From hundreds of testimonials we select a few.

From Jas. S. Athon, Sup't Indiana Hospital for the Insane.

INDIANAPOLIS, MARCH 16, 1857.

The undersigned desires to say that he believes that Munson's Tubular Lightning Rod with Spiral Flanges, possesses all the elements necessary to meet the object of securing a building from the effects of Lightning. The numerous points presented for receiving and conducting Electricity, is a desideratum fully combined in this Rod; and judging from my own observation at this Institution, where the common iron rod and the Tubular are in use, that the latter is far superior as a conductor, and moreover is easier put up, and easier secured to the building.

JAS. S. ATHON, Sup't.

From Edward B. Stevens, M. D., Ed. Cin'ti Medical Observer.

MR. MUNSON—Dear Sir:—I have examined your new Lightning Rod, and am free to express a favorable opinion of your invention. Its Material is one of our best Conductors of Electricity, being very greatly superior to iron; while the form of Construction combines a great degree of strength for the amount of the material used. I very cheerfully commend it to the public.

EDWARD B. STEVENS, M. D.,

Editor of Cincinnati Medical Observer.

From R. T. Brown, M. D., Crawfordsville, Ind., State Geologist.

I have carefully examined the specimen of Lightning Rod which I received by Express from you, and am inclined to think very favorably of the invention. Copper is a much better Conductor of Electricity than Iron; indeed it is among the best conductors known. The conducting power of an Electrode is not as the amount of metal, but as the surface exposed, and as this device exposes an internal and external surface, it must have strong conducting powers. I would not hesitate to commend Mr. Munson's Rod to all who wish a perfect protection from accidents by lightning.

Yours truly,

R. T. BROWN.

Munson's Lightning Rod has been selected by the Building Committee of the Cincinnati School Board.

CINCINNATI, O., AUGUST 6th, 1856.

MR. DAVID MUNSON, Indianapolis, Ind.—Dear Sir: The Building Committee of the School Board have expressed a favorable opinion of your Lightning Rod, and have agreed to have two of them put up forthwith—on the Adams and Elm Street Building, under the direction of Mr. Edward Van Keuren, Building Superintendent.

I am respectfully yours,

JOHN D. CALDWELL, Clerk.

From John Young, Professor of Natural Science, in North-Western Christian University.

INDIANAPOLIS, JUNE 1, 1857.

I have examined an improvement in Lightning Rods, by D. Munson, of Indianapolis. I regard it as superior to other rods in the following particulars:

1st. The material of which it is made has a high conducting power. 2d. It exposes a large extent of surface without a great increase in the cost. 3d. The Tubular Spiral form imparts the requisite amount of stability and strength. I can therefore recommend it.

JOHN YOUNG,
Prof. Natural Science, in North-Western Christian University.

From the President of Kenyon College, Gambier, Ohio.

GAMBIER, FEBRUARY 25, 1858.

With regard to the new style of Lightning Rod invented by David Munson, I have no hesitation in saying that it is superior to anything of the kind which I have seen. Indeed I do not know how a rod could be made to combine more of the requisites for protection against Lightning. Copper is one of the very best of Conductors, much superior to iron, because of its greater conducting power, and less liability to rust. The Tubular Spiral form of Munson's Rod gives it large extent of surface and great strength at small cost. It will certainly go into general use.

LORIN ANDREWS.

From Geo. B. Stone, Sup't of Public Schools, Indianapolis.

INDIANAPOLIS, SEPTEMBER 15, 1856.

DAVID MUNSON, Esq.:—Your Lightning Rods possess two important advantages which make them superior to any I have seen. One is the material used, Copper, which, as is well known, is a better conductor than iron, and, another more important still, is the amount of conducting surface. The hollow tube I consider a great improvement upon the solid rod, heretofore in general use.

Respectfully yours,
G. B. STONE,
Superintendent of Public Schools, Indianapolis.

From the New York Tribune.

Mr. David Munson, of Indianapolis, Ind., has just patented a very novel, evidently cheap, and we should judge very efficient Lightning Rod. It is made of thin rolled copper, and is shaped by suitable machinery into a kind of tube with two large ridges or sharp edges on opposite sides; the whole being twisted and made to appear considerably more cleanly and ornamental than any of the iron conductors within our knowledge. The sharp edges appear well calculated for receiving the fluid in the same manner as do the points frequently provided along the sides of iron ones, and the whole contour appears well designed to afford great surface and considerable strength with little weight, and, we presume, moderate cost.

In the Tribune of a subsequent date another editorial notice appears, from which the following is extracted:

Mr. David Munson, an ingenious mechanic of Indianapolis, has patented a novel and very possibly, a valuable improvement in Lightning Rods, the design being to employ a superior conductor and present a very extensive surface to attract the electric fluid, &c.

From the Indiana State Sentinel.

Indianapolis has an inventor and patentee who has succeeded in furnishing a Lightning Rod vastly more valuable than any that has hitherto been used. David Munson, is the man whose ingenuity and industry have accomplished this desirable end. The Lightning Rod is constructed of copper, is handsome, lasts longer, and is a better protection against the disastrous effects of electricity than any other rod possibly can be.

From the Indianapolis Daily Journal.

Our fellow-citizen, Mr. David Munson, has recently invented and patented a Lightning Rod, which promises to supercede all that are now in use. It is made of copper—it is light, very strong for the amount of material used, and presents a great extent of surface for conducting electricity; and moreover, it can be furnished nearly as cheap as the iron rod, is vastly more efficient and will last ten times as long.

For State or County Rights, or Rods at wholesale, address,

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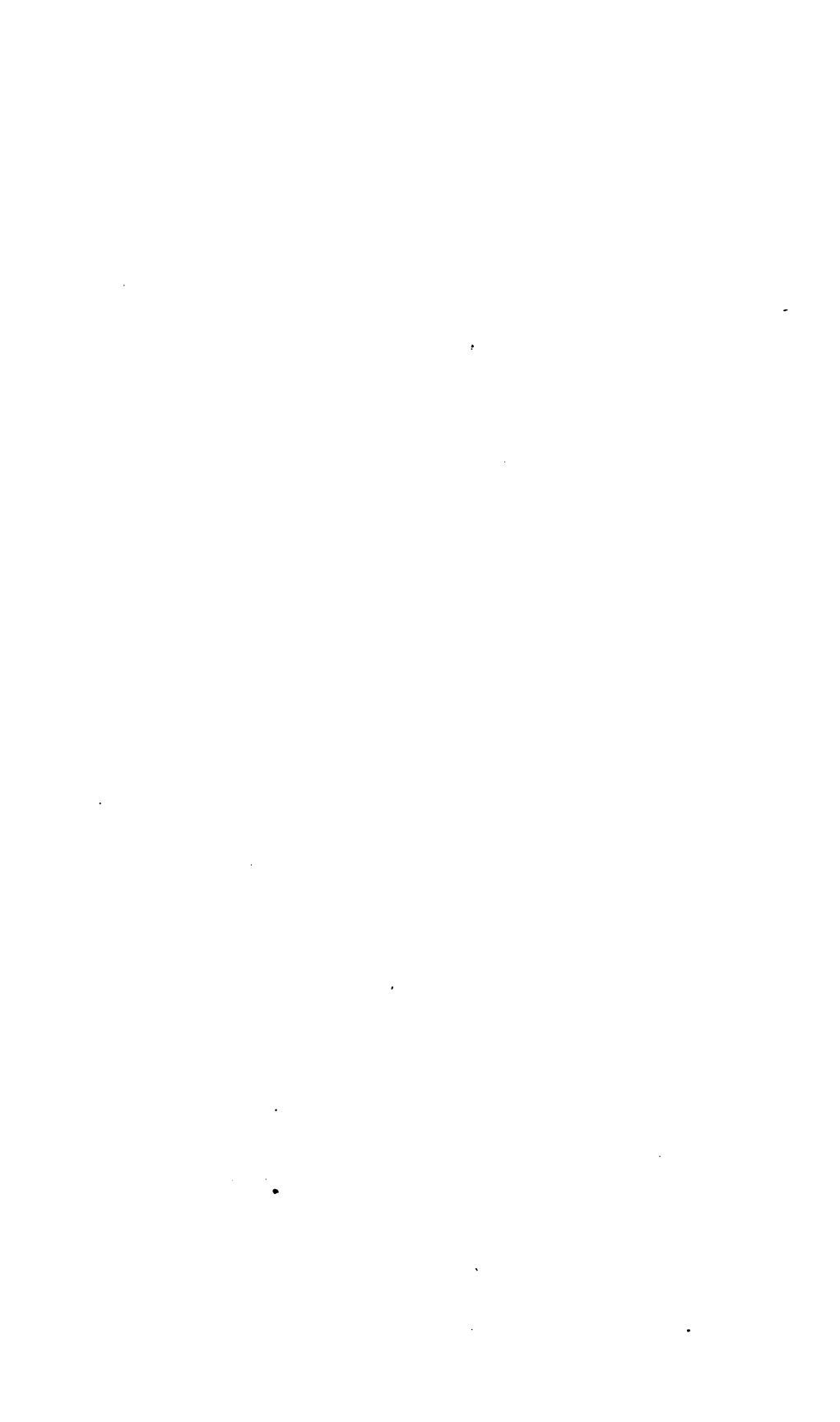
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